MOTOROLA

Implementing Remote Control for Siren Systems

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Abstract

In early days mechanical siren systems were manually activated. In a later stage when electrical sirens were installed, a great improvement was achieved by implementing remote activation of these sirens via telephone lines. While this concept worked well for many years, its reliability was dependent on availability of the lines, and the remotely activated functions were limited to the basic operation such as: on/off, power fail, etc.

Today operators of siren systems require higher level of control and more meaningful information on the status of the siren. In addition, as electronic siren systems become available, the operator can activate the siren in various modes, which expand the use of the sirens to more than military warning.

Implementation of these capabilities require more powerful console for controlling the sirens and obviously more reliable communications between the siren and the control center. Use of a computer system with a single PC or multiple PCs connected in a network is the right approach. In addition providing prime and backup communication media is of vital importance. Selection of the media: lines, radio, satellite, dial-up network, etc. depends on availability of the media and its capability to support such a critical system. Modern sirens serve for multiple purposes such as:

- Early warning in case of extreme weather condition using multiple tone options
- Public announcement in case of severe emergency
- Warning of the public in case of emergency (A-B-C atomic, biologic, chemical)
- Activation of siren signal to advise the public about a special event.

Today's siren system include electronic controllers equipped with communication. This allows implementing new operational features such as:

- Silent test of the siren and the communication network
- Power system testing including power backup
- Activation of sirens from multiple control center locations
- Possibility to select any combination of simultaneously activated sirens
- Backup communication utilizing FM broadcasting receivers

Communications

In order to match the requirement for operating functions and multiple applications, the system must be equipped with a reliable, flexible, expandable and cost effective communication network. This is especially important for designing a nationwide siren system, in which hundreds to thousands of sirens are installed throughout the country.

No doubt that connecting the siren controllers to physical line infrastructure would allow meeting the key requirements. However our experience gained by installing multiple siren system with total of several thousands of siren Remote Terminal Units (RTUs) show, that line communication is not available at these locations.

Due to requirement to build a very reliable but still cost-effective solution, operators of siren systems select radio communication as a prime media or as a secondary media. Among the reliable radio communication media are conventional and conventional VHF /UHF radio frequency (RF) networks and UHF and 800/900 MHz Trunked radio networks.

When selecting a communication media for a critical application such as nationwide siren system, operator prefer to rely on a private communication network, rather being part of a shared / public communication provider. Among the key communication features of a reliable siren systems are the following:

- Integration of multiple communication media into a nationwide network
- End-to-end acknowledgment of all (both way) transmitted messages
- Direct RTU-to-RTU link to allow diagnostics and siren activation from any site
- Use of a powerful seven layers protocol based on ISO/OSI standard.
- Programmable communication network.

Radio implementation options

When designing a communication network and selection of the data communication protocol one must make sure, that the overall system will efficiently meet the following capabilities:

- Fast handling of reported messages and alarms received from the siren RTUs
- Efficient handling of problem resulted in from communications interference
- Automatic switching to redundant communication channel
- Air time efficiency - Use of the same channel for supporting large number of RTUs
- Activation of multiple sirens via a single-broadcast message
- Remote diagnostics of siren conditions and RTU over the communication network
- Remote downloading of new configurations and operating programs via the network

RTU Features for supporting Siren systems

Remote control capability in siren systems depends on the RTU capability to execute the local application at the siren site and at the same time communicate with the control center. Among the most important RTU features needed for a siren system are:

- Seamless interfacing to multiple control centers using industry standard connectivity such as MODBUS, TCP/IP, DNP 3.0, etc.
- Interfacing to a wide range of sirens is provide via discrete I/O connection and serial ports, while emulating the protocol of the selected siren interface unit.
- Security of the siren activation is achieved by utilizing a range of password levels, each suitable for the qualified person (activation, maintenance, programming, etc.)
- The communication security is enhanced by implementing coding of the transmitted messages and authentication embedded into the RTU application program.

System programming and maintenance tools

All programming needs of MOSCAD type units are served by a single tool. It has the capability to define the application program, configure the communication network and download these to each designated RTU. The MOSCAD ToolBox is a Windows™ based software program running on Pentium ™ based PCs, compatible with Windows 3.11, Windows 95™ and Windows NT ™ systems.

The ToolBox software is updated in parallel to MOSCAD RTU new software releases, and all new software versions automatically support MOSCAD RTUs loaded with the previous software versions. The ToolBox may be connected directly to RTUs, or communicate with the related RTUs via the RF network. Remote programming of MOSCAD RTUs can be simultaneously done over the SCADA communications network, while other parts of the system are operating normally.

The ToolBox provides means to read the error logger embedded into each MOSCAD RTU. The ToolBox performs hardware test and calibration of the I/O modules and set its real-time clock. The ToolBox includes a powerful application generator which allows writing of programs in Ladder Diagram or C++ languages. It also include a set of pre-defined library programs, for simple configuration of standard RTUs.

System Description

Motorola implemented couple of remote control siren systems. One of the large systems incorporates over 1000 sirens throughout the country. The system is managed from multiple control centers including:

- Main control center
- Several Urban control centers
- Several regional control centers
- Military sub-control center

- Airforce control center
- Mobile control center
- Local activation panels (in the siren site).

The main communication in each site to all siren RTUs is via UHF radio communications. The alternate (redundant) communication link is done via FM Broadcast receiver. Connectivity between the main Control Center and the various sub-control centers is done via wirelines. In this case the backup communications is done via UHF radio. See Figure 1. below

The system utilizing several UHF frequencies on the nationwide basis. As geographical conditions allow these channels are re-used in the various regions. The system includes specific coding and de-coding software techniques, which were developed by the end user and downloaded into each RTU and control center. This high level of security was made possible due to the capability of the MOSCAD operating system to integrate software programs imported after system installation and performance verification.

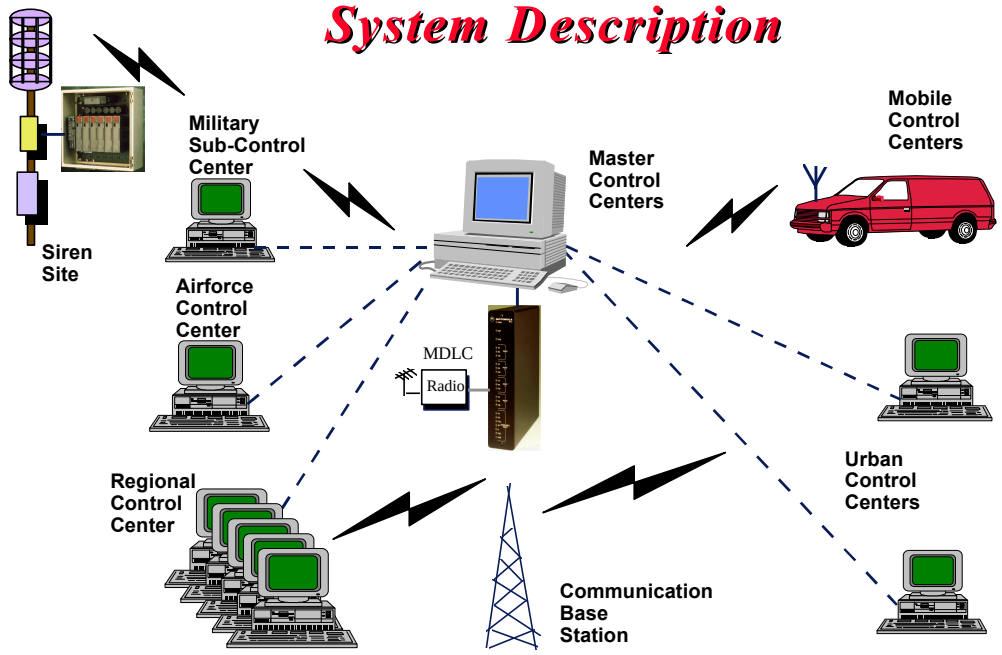

Figure 1. Siren System Diagram

Summary

The MOSCAD RTU is well suited for siren remote control and the above described system is in full operating condition over five years. The reliability of the MOSCAD RTU and operation of the system together with the control center confirmed by minimum outages.

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